Nora Loose

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Research Interests

Physical & computational oceanography, North Atlantic-Arctic connectivity, Ice-ocean interactions, Ocean observing system design, Inverse and adjoint modeling, Uncertainty quantification

Education

01/2015 - 08/2019 **University of Bergen**, Bergen, Norway.
Ph.D. in **Physical Oceanography**
- Thesis: *Adjoint Modeling and Observing System Design in the Subpolar North Atlantic*
- Advisors: Kerim H. Nisancioglu (University of Bergen), Patrick Heimbach (UT Austin)
- Funded by European Research Council project ice2ice

04/2007 - 02/2013 **University of Bonn**, Bonn, Germany.
Diploma (equiv. M.Sc. degree) in **Mathematics**, **with Honors**
- Specialization: Stochastic Analysis; Minor: Physics
- Grade Point Average: 1.0, on a scale from 1.0 (excellent) to 4.0 (pass)

Professional Appointments

10/2018 - present **Research Fellow**, *Oden Institute for Computational Engineering and Sciences*, University of Texas at Austin, USA.
- Mentor: Patrick Heimbach
- Investigate dynamical teleconnections in the North Atlantic and Arctic Ocean
- Develop quantitative and physics-informed methods for ocean observing system design

03/2013 - 08/2014 **Research Fellow**, *Department of Mathematics*, ETH Zurich, Switzerland.
- Conducted research in the fields of Geometric Analysis and Partial Differential Equations
- Taught courses for graduate and undergraduate students

Teaching and Outreach

02/2020 **Volunteer**, *Girl Day STEM Festival*, UT Austin.
- hands-on science activities and demonstrations for elementary and middle school students

03/2013 - 08/2014 **Teaching Assistant**, *Department of Mathematics*, ETH Zurich, Switzerland.
- Taught 3 math courses (*Measure Theory and Integrals, Differential Geometry I & II*) for graduate and undergraduate students
- *Teaching evaluations*: 4.8 (2013), 4.9 (2014) on a scale from 1 (very bad) to 5 (excellent)

07/2013 **Teaching Assistant**, *PCMI Graduate Summer School*, Park City, USA.
- Taught advanced math course (*Weak immersions of surfaces with L^2-bounded second fundamental form*, lecture notes) for Ph.D. students and postdocs

10/2008 - 02/2013 **Teaching Assistant**, *Department of Mathematics*, University of Bonn, Germany.
- Taught 3 math courses (*Mathematics for Physicists I, Analysis II & III*) for undergraduate students

01/2010 - 04/2010 **Teaching Assistant**, *Department of Mathematics*, University of Toronto, Canada.
- Taught math course (*Linear Algebra*) for undergraduate students

2009 - 2011 **Organizer of outreach events**, *Hausdorff Center for Mathematics*, University of Bonn, Germany.
- Organized and led math outreach events for students from elementary and secondary school
- Ran bi-weekly club to foster students' talent for mathematics

Professional Service

Organization of Conferences

04/2017 Co-Convener for the session "Quaternary climate archives and proxy uncertainty", EGU General Assembly 2017.

09/2015 Co-Organizer of PhD conference "Connecting the ocean, atmosphere and ice sheets", 20 participants, Denmark.

Awards and Scholarships

04/2019 **Rising Stars in Computational & Data Sciences**, *Oden Institute for Computational Engineering and Sciences*, University of Texas at Austin, USA.

- Selected to attend the competitive and international career event "Rising Stars in Computational & Data Sciences" for women

03/2018 **Best Presentation Award**, *Research School on Changing Climates in the Coupled Earth System*, Sommarøy, Norway.

02/2016 **Research Grant**, *Norwegian Research School in Climate Dynamics*, NOK 20,000, for research stay at MIT.

2013 - 2016 **Scholarships for various summer schools**.

- IARC Summer School 2016, *International Arctic Research Center, University of Fairbanks*
- ACDC Summer School 2015, *Norwegian Research School in Climate Dynamics*
- New Directions Short Course IMA 2015, *Institute for Mathematics and its Applications, University of Minnesota*
- PCMI Summer School 2013, *Institute for Advanced Study, Princeton*

02/2013 **Award "Diploma with Honors"**, *Department of Mathematics, University of Bonn*, for graduating with highest possible grade point average.

2009/10 **Scholarship for Study Abroad Program at the University of Toronto**, *University of Bonn*, Germany.

2008 - 2012 **German Academic Scholarship Foundation Award**, *Studienstiftung des deutschen Volkes*, for outstanding academic achievements (given to 0.5% of German university students).

2006 **Ferry Porsche Award**, *Porsche AG*, for excellent performance in mathematics and physics.

2006 **Award German Physical Society**, *German Physical Society*, for excellent performance in physics.

2006 **Award Reinhold Beitlich Foundation**, *Reinhold Beitlich Foundation*, for exceptional results in the Abitur (equiv. high-school diploma).

Publications

Journal Arcticles

J1 Y. Fujii, E. Rémy, H. Zuo, P. Oke, G. Halliwell, F. Gasparin, M. Benkiran, **N. Loose**, J. Cummings, J. Xie, Y. Xue, S. Masuda, G.C. Smith, M. Balmaseda, C. Germineaud, D.J. Lea, G. Larnicol, L. Bertino, A. Bonaduce, P. Brasseur, C. Donlon, P. Heimbach, Y. Kim, V. Kourafalou, P-Y. Le Traon, M. Martin, S. Paturi, B. Tranchant and N. Usui. Observing System Evaluation Based on Ocean Data Assimilation and Prediction Systems: On-Going Challenges and a Future Vision for Designing and Supporting Ocean Observational Networks, *Front. Mar. Sci. 6:417*, 2019. doi: 10.3389/fmars.2019.00417.

Preprints

P1 **N. Loose**, P. Heimbach, H. Pillar and K.H. Nisancioglu. Quantifying Dynamical Proxy Potential through Oceanic Teleconnections in the North Atlantic. Preprint: doi: 10.1002/essoar.10502065.1

In Preparation

P2 **N. Loose** and P. Heimbach. Physics-driven Design of Observing Systems via Uncertainty Quantification in Ocean State Estimation, *in prep., planned submission: April 2020*

P3 **N. Loose**, P. Heimbach, H. Pillar and K.H. Nisancioglu. The Dynamical Proxy Potential of the OSNAP Array, *in prep., planned submission: May 2020*

P4 **N. Loose**, H. Pillar, M. Årthun, K.H. Nisancioglu and P. Heimbach. Remote Drivers of Nordic Seas Heat Content Anomalies and Climate Predictability, *in prep., planned submission: Fall 2020*

P5 **N. Loose**, K.H. Nisancioglu and P. Heimbach. Ocean Heat Supply to Greenland's Margins: Sensitivity to far field ocean changes, *in prep.*

Thesis

T1 **N. Loose**. Adjoint Modeling and Observing System Design in the Subpolar North Atlantic, *Ph.D. Dissertation*, University of Bergen, 2019

Presentations

Invited Talks

03/2020 **SIAM Conference on Uncertainty Quantification**, *Munich, Germany*, conference cancelled due to COVID-19.

02/2020 **Ocean Sciences Meeting 2020**, *San Diego, USA*.

04/2018 **EGU General Assembly 2018 (solicited)**, *Vienna, Austria*.

03/2018 **University of Edinburgh**, *Edinburgh, UK*.

03/2018 **Northumbria University**, *Newcastle, UK*.

Conference Presentations

10/2018 **ECCO Meeting**, *Austin, USA*.

07/2018 **Workshop on Sensitivity Analysis and Data Assimilation in Meteorology and Oceanography**, *Aveiro, Portugal*.

06/2018 **Adjoint (TACOMA) Workshop**, *Oxford, UK*.

03/2018 **CHESS Meeting**, *Sommarøy, Norway*.

Posters

06/2017 **Data Assimilation Workshop**, *Bergen, Norway*.

05/2017 **PAGES Workshop**, *Louvain-la-Neuve, Belgium*.

04/2017 **EGU General Assembly 2017**, *Vienna, Austria*.

03/2017 **Workshop on Emerging Applications of Data Assimilation in the Geosciences**, *Leiden, Netherlands*.

12/2016 **AGU Fall Meeting 2016**, *San Francisco, USA*.

Selected Courses

Oceanography & Modeling

Fall 2016 **Introduction to Ocean Modeling**, *Instructor: Patrick Heimbach*, UT Austin, USA.
Conservations laws, approximations, discretisation, parameterization schemes, adjoint modellng.

02/2016 **Large Scale Turbulence in Atmosphere and Ocean**, *Instructor: Joe Lacasce*, University of Oslo, Norway.
2D turbulence, 3D turbulence, geostrophic turbulence, turbulent diffusion.

11/2015 **HPC Course**, University of Bergen, Norway.
High-Performance Computing (HPC), MPI and OpenMP programming, build systems, revision systems, debugging.

Spring 2015 **Numerical Modeling**, University of Bergen, Norway.
Finite difference methods, explicit and implicit schemes, staggered grids and time steps, stability analyses, relaxation methods for boundary value problems, flux limiter and TVD schemes.

Data Assimilation & Uncertainty Quantification

Fall 2017 **Computational methods for inverse problems**, *Instructor: Omar Ghattas*, UT Austin, USA.
Theory and numerical solution of PDE-constrained inverse problems.

06/2017 **Crash Course on Data Assimilation - Theoretical foundations and advanced applications with focus on ensemble methods**, NERSC, Bergen, Norway.
EnKF, data assimilation for climate prediction and chaotic dynamics, model error, particle filters.

06/2015 **Introduction to Uncertainty Quantification**, *Instructors: Youssef Marzouk, Luis Tenorio*, Institute for Mathematics and its Applications, University of Minnesota, USA.
Bayesian statistics, uncertainty quantification, model validation, model reduction, MCMC methods.

Mathematics

2009 **Stochastic Processes**, University of Bonn, Germany.
Gaussian processes, Markov processes, Gibbs measures, Random walks, Brownian motion

2010/11 **Stochastic Analysis**, University of Bonn, Germany.
Martingales, Stochastic integrations, Ito calculus, Stochastic differential equations

Field Work

07/2017 - 08/2017 **East Greenland Ice-Core Project (EastGRIP)**, *Greenland*.
- Drilled shallow ice cores, conducted surface measurements and lab work in the science trench

08/2016 - 09/2016 **G.O. Sars**, *Irminger Sea*.
- Collected physical oceanographic data and marine sediment cores for the Ice2Ice project (ERC)

Skills

Programming

- Python, MATLAB, Fortran, Unix/Linux operating systems, github, LaTeX.

Languages

- *Fluent in:* German, English, Norwegian; *Basic knowledge in:* Spanish, Italian.